

## PATENT COOPERATION TREATY

## PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT  
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 77139 TN/kp	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/IB 03/00832	International filing date (day/month/year) 06.03.2003	Priority date (day/month/year) 07.03.2002
International Patent Classification (IPC) or both national classification and IPC B65D65/40		
Applicant INTER IKEA SYSTEMS B.V. et al.		

<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 4 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 14 sheets.</p>
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I <input checked="" type="checkbox"/> Basis of the opinion</li> <li>II <input type="checkbox"/> Priority</li> <li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV <input type="checkbox"/> Lack of unity of invention</li> <li>V <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI <input type="checkbox"/> Certain documents cited</li> <li>VII <input type="checkbox"/> Certain defects in the international application</li> <li>VIII <input type="checkbox"/> Certain observations on the international application</li> </ul>

Date of submission of the demand 02.10.2003	Date of completion of this report 08.06.2004
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer  Cazacu, C Telephone No. +49 89 2399-2645



INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT

International application No. PCT/IB 03/00832

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, Pages**

1, 1a, 2-8 received on 19.04.2004 with letter of 15.04.2004

**Claims, Numbers**

1-6 received on 19.04.2004 with letter of 15.04.2004

**Drawings, Sheets**

1/2-2/2 received on 19.04.2004 with letter of 15.04.2004

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- the description, pages:
- the claims, Nos.:
- the drawings, sheets:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/IB 03/00832

5.  This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes: Claims	1-6
	No: Claims	
Inventive step (IS)	Yes: Claims	1-6
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-6
	No: Claims	

**2. Citations and explanations**

**see separate sheet**

V.

1. Document EP-A-0 424 526 (D1), which is considered to represent the most relevant state of the art, discloses (cf. Figs. 4, 6) a packaging material from which the subject-matter of claim 1 differs in that a) it comprises a second auxiliary corrugated paper layer and b) by a phase displacement in the range of  $\pi/4$  to  $\pi/3$  between the waves of the auxiliary corrugated layers.

Should the problem to be solved be to improve the rigidity of the structure, the use of a second corrugated paper layer is described in document US-A-6 207 242 (D3) (see Fig. 3) as providing the same advantages as in the present application.

Referring to the phase displacement feature, the same document D3 discloses (Fig. 3) the presence of a displacement ( $90^\circ$  or  $\pi/2$ ) between corresponding waves.

However, no prior art document at hand discloses a phase displacement in this range and the choice of such a value outside the salient points of the sinusoid ( $\pi/2$ ;  $\pi$ , etc) does not appear obvious to the skilled person in the light of the prior art at hand (for example, document US-A-4 012 276 (D4), cited by the examiner and appended to the present written opinion, discloses wave phase displacement, but this is the result of using different types of corrugated layers, not identical ones). The use of a wave phase displacement between identical corrugated layers is nowhere disclosed or hinted at in the prior art at hand.

Consequently, the subject-matter of claim 1 is not disclosed by any prior art document taken alone or in any relevant combination with other prior art document and appears to meet the requirements of Article 33 (2) and (3) PCT. Claims 2-6 depend on claim 1 and as such meet the same requirements of Article 33 (2) and (3) PCT.

Further, the invention claimed in claims 2-6 is industrially applicable in the sense of Article 33 (4) PCT.

0/507093

Title: A packaging material of the corrugated cardboard type

Technical Field.

A packaging material of the corrugated cardboard type as stated in the preamble of claim 1.

5 Background Art

It is known to manufacture corrugated cardboard which includes a plane paper layer. A corrugated auxiliary paper layer is glued onto the plane paper layer, and the corrugations of said auxiliary paper layer present an amplitude perpendicular to the direction of propagation of the packaging material. All the ridges are arranged as rectilinear parallel corrugations. However, problems are involved in forming folding lines in the material as a folding along a specific line has a tendency to be staggered relative to the adjacent vales. In addition, a printing by means of raster on the plane paper layer implies due to the washboard effect that the printed colours opposite the ridges are of a slightly different tint than the colours opposite the wave. In addition, the tear resistance parallel to the waves is weak. The rigidity of the material and the capability of absorbing impacts of said material are not so good either as said material is not sufficiently stiff.

EP-A-0424526 (Figs. 4 and 6) discloses a packaging material with only one auxiliary corrugated layer.

20 WO-A-071277 discloses a sheet and strip material with only one corrugated auxiliary layer.

1a

US-A-6207242 (Fig. 3) discloses a packing material with two auxiliary corrugated layers of the same type, the phase displacement between corresponding waves being

90° or  $\frac{\pi}{2}$ .

US-A-4012276 discloses a packaing material with two auxiliary corrugated layers of 5 a different type, a wave phase displacement existing between said layers of a different type.

Brief Description of the Invention

The object of the invention is to provide a packaging material of the above type which is more suited for being subjected to a printing than hitherto known, which is more stiff 10 than hitherto known, and which presents an improved tear resistance.

The packaging material according to the invention is characterised in the features stated in the characterising clause of claim 1. The two auxiliary corrugated layers are of the same type. As a result, the packaging material becomes more stiff than hitherto known, viz flexurally rigid, without the lightness and voluminocity of the material being affected. The folding of such waves requires a considerable force. In addition, the material turned out to be highly suited for imprints. The tear resistance has been increased because the possibility of tearing up the material along a wave has been reduced. The folding lines are very distinct as they always extend across some ridges.

According to the invention, the plane paper layer and the auxiliary paper layer may be of the same thickness, preferably between 0.05 and 0.3 mm, and preferably be approximately 0.1 mm, where the auxiliary paper layer may be of a weight of 50 to 250 g/m<sup>2</sup>, especially 70 to 150 g/m<sup>2</sup>. The resulting packaging material is very durable.

Moreover, in the packaging material according to the invention a starch-based glue or cold-water glue may be used for the lamination of the layers. Such a packaging material turned out to present a high cohesive power and a long durability.

According to the invention, the surface of each auxiliary paper layer may follow a face substantially corresponding to the functional expression:

$$z(x, y) = \text{asin}\left(\frac{2\pi}{\lambda_1}x + \frac{\pi}{2} + b\sin\frac{2\pi}{\lambda_2}y\right)$$

where  $a$  and  $\lambda_1$  represent the amplitude and the wavelength, respectively, of the waves perpendicular to the plane of propagation of the auxiliary paper layer, and where  $b$  and  $\lambda_2$  represent the amplitude and the wavelength, respectively, of the waves in the plane

of said auxiliary paper layer, the ratio  $\frac{a}{b}$  of the amplitudes for the two types of waves

5 being be in the range of 0.10 to 0.60, preferably 0.15 to 0.50, especially 0.22 corresponding to  $a = 0.5$  mm and  $b = 2.25$  mm This embodiment of the packaging material turned out to be particularly stiff and suited for transportation of large separate furniture parts and plates.

Furthermore, the ratio  $\frac{\lambda_1}{\lambda_2}$  of the wavelengths for the two types of waves may accord-

10 ing to the invention be in the range of 0.09 to 0.20, preferably 0.15 corresponding to  $\lambda_1 = 3.5$  mm and  $\lambda_2 = 23.5$  mm. This has proved particularly advantageous.

Finally, the waves of at least one type of waves may according to the invention be rather flat on the sides in such a manner that said waves are substantially serrated where the ridges and the grooves are slightly rounded, or the waves may be substantially square. As a result, an inexpensive manufacture of the auxiliary paper layer is obtained 5 because the pressing tools used for pressing the auxiliary paper layer into shape can be manufactured at a lower price than hitherto known.

Brief Description of the Drawing

The invention is explained in detail below with reference to the drawing, in which

Fig. 1 is a perspective view of a portion of a packaging material according to the invention, where a small phase displacement appears between the waves presenting an amplitude perpendicular to the first auxiliary paper layer and the waves presenting an amplitude perpendicular to the second auxiliary paper layer, and 10

Fig. 2 discloses in an XYZ-coordinate system an ideal embodiment of the waves of an auxiliary paper layer,

Best Mode for Carrying Out the Invention

The portion of the packaging material shown in Fig. 1 is formed as a laminate including a plane paper layer 11 and an auxiliary paper layer 12 arranged below the layer 11. Below the auxiliary layer 12 there is arranged a second plane paper layer 13. Below the 5 latter there is arranged a second auxiliary paper layer 14 and optionally a third plane paper layer 15. The auxiliary paper layers include waves presenting an amplitude a perpendicular to the plane of propagation of the auxiliary paper layer, viz. follow the direction parallel to the arrow A. The wave top of these waves form in the auxiliary paper layers 12 and 14 a system of substantially parallel waves presenting amplitudes 10 b in the plane of propagation of the auxiliary paper layers. The latter waves can also be called oscillating in parallel.

The plane paper layers 11 and 13 and the auxiliary paper layers 12 and 14 may be of the same thickness, preferably between 0.05 and 0.3 mm, such as 0.1 mm. Each auxiliary paper layer can for instance be of a weight of 50 to 250 g/m<sup>2</sup>, especially 70 to 150 15 g/m<sup>2</sup>.

A glue, such as a

starch-based glue or a cold-water glue, can for instance be used for the lamination of the layers.

As shown in Fig. 2 the surface of each auxiliary paper layer 12 and 14 can follow a face substantially corresponding to the mathematical functional expression:

$$z(x, y) = a \sin\left(\frac{2\pi}{\lambda_1} x + \frac{\pi}{2} + b \sin\frac{2\pi}{\lambda_2} y\right)$$

- 5 where  $a$  and  $\lambda_1$  represent the amplitude and the wavelength, respectively, of the waves perpendicular to the plane of propagation of each auxiliary paper layer 13, and where  
 10  $b$  and  $\lambda_2$  represent the amplitude and the wavelength, respectively, of the waves formed by the wave tops of the above-mentioned waves and presenting an amplitude in the plane of said auxiliary paper layers 12 or 14. The expression applies to a rectilinear  
 XYZ-coordinate system.

The ratio  $\frac{a}{b}$  of the amplitudes for the two types of waves can be in the range of 0.10

to 0.60, preferably 0.15 to 0.50, and especially 0.22 corresponding to  $a = 0.5$  mm and  $b = 2.25$  mm.

The ratio  $\frac{\lambda_1}{\lambda_2}$  of the wavelengths for the two types of waves can be in the range of 0.09

- 15 to 0.20, and preferably be approximately 0.15 corresponding to  $\lambda_1 = 3.5$  mm and  $\lambda_2 = 23.5$  mm.

As far as the waves are concerned which present an amplitude  $\alpha$  perpendicular to the direction of propagation of the auxiliary paper layers 12 and 14, a small phase displacement  $\varphi$  is provided between the waves of these layers, conf. Fig. 1.  $\varphi$  is in the range of  $\frac{\pi}{4} < \varphi < \frac{\pi}{3}$ . The plane paper layer 15 is optional.

- 5 In the auxiliary paper layers 12 and 14, at least the waves presenting an amplitude perpendicular to the plane of propagation of the packaging material may be provided with rather flat sides in such a manner that said waves are substantially serrated. The serrations can be provided with slightly rounded tops and bottoms, viz. triangularly wavy.
- 10 The waves presenting the amplitude perpendicular to the plane of propagation of the packaging material may also be substantially of a square wavy shape.

The packaging material according to the invention is advantageous in presenting a high flexural rigidity and a high capacity of absorbing impacts. In addition, the mate-

- rial presents a high tear resistance because the possibility of tearing up the material along the waves has been highly reduced or eliminated. Furthermore, the material is advantageous in including folding lines which are always distinct because they always continue across the ridges which is an important feature in connection with a mechanical packing of articles. The washboard effect is minimized. Furthermore, the material is very suited for being provided with a graphical print. The material turned out to be particularly suited for packing plane furniture parts. Finally it should be noted that by using the packaging material according to the invention in connection with a packing machine it is possible to use the latter in a more efficient way.
- 5
- 10 Each plane paper layer can, of course, be of a weight in grammes per  $m^2$ , which deviates from the weight in grammes per  $m^2$  of each single auxiliary paper layer.

The invention may be modified in many ways without thereby deviating from the scope of the invention.

Claims

1. A packaging material of the corrugated cardboard type made by gluing together a plane paper layer (11) and an auxiliary paper layer (12) with waves presenting an amplitude (a) perpendicular to the plane of propagation of the auxiliary paper layer, and 5 where the wave tops form a system of substantially parallel waves (10, 10', 10'') presenting an amplitude (b) in the plane of propagation of said auxiliary paper layer (13), a second plane paper layer (13) being arranged below said auxiliary paper layer (12), characterised in, that it comprises a second auxiliary paper layer (14) arranged below said second plane paper layer (13) and optionally a third plane paper layer (15) and in 10 that as far as the waves are concerned which present an amplitude perpendicular to the direction of propagation of the two auxiliary paper layers (12, 14), a phase displacement  $\phi$  is provided between the waves of these layers,  $\phi$  being in the range of

$$\frac{\pi}{4} - \frac{\pi}{3}$$

2. A packaging material according claim 1, characterised in, that the waves of at least 15 one type of waves on the auxiliary paper layers (12, 14) are rather flat on the sides in such a manner that the waves are of a substantially serrated shape, viz. triangular waves with tops and bottoms which are optionally slightly rounded, or the waves can be substantially "square", viz. square waves.

3. A packaging material according to claim 1, characterised in, that the surface of 20 each auxiliary paper layer (12,14) follows a face substantially corresponding to the mathematical functional expression:

$$z(x, y) = a \sin\left(\frac{2\pi}{\lambda_1} x + \frac{\pi}{2} + b \sin \frac{2\pi}{\lambda_2} y\right)$$

9a

where  $a$  and  $\lambda$ , represent the amplitude and the wavelength, respectively, of the waves perpendicular to the plane of propagation of the auxiliary paper layer, and where  $b$  and

$\lambda_2$  represent the amplitude and the wavelength, respectively, of the waves in the plane of said auxiliary paper layer, viz. the plane of propagation, and that the ratio  $\frac{a}{b}$  of the

amplitudes for the two types of waves may be in the range of 0.10 to 0.60, preferably 0.15 to 0.50, especially 0.22 corresponding to  $a = 0.5$  mm and  $b = 2.25$  mm.

- 5 4. A packaging material according to one or more of the claims 1 to 3, **characterised in**, that the ratio  $\frac{\lambda_1}{\lambda_2}$  of the wavelengths for the two types of waves is in the range of 0.09 to 0.20 and preferably is approximately 0.15 corresponding to  $\lambda_1 = 3.5$  mm and  $\lambda_2 = 23.5$  mm.

- 10 5. A packaging material according to claim 2, **characterised in**, that the plane paper layers (11, 13) and the auxiliary paper layers (12, 14) are of the same thickness, preferably between 0.05 and 0.3 mm, such as 0.1 mm, and that the auxiliary paper layers (3) is of a weight of 50 to 250 g/m<sup>2</sup>, especially 70 to 150 g/m<sup>2</sup>.

6. A packaging material according to claim 1 or 2, **characterised in**, that starch-based or cold-water glue is used for the lamination of the layers.

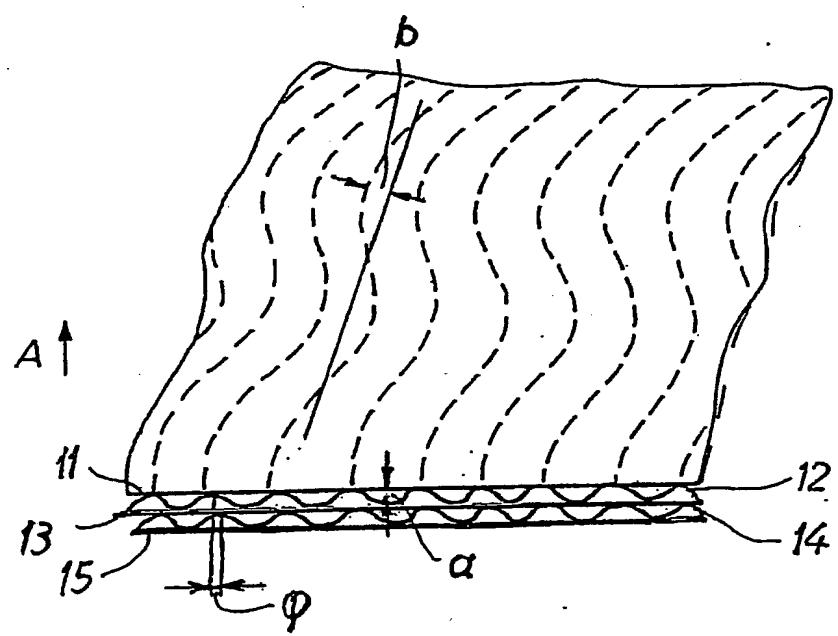


Fig. 1

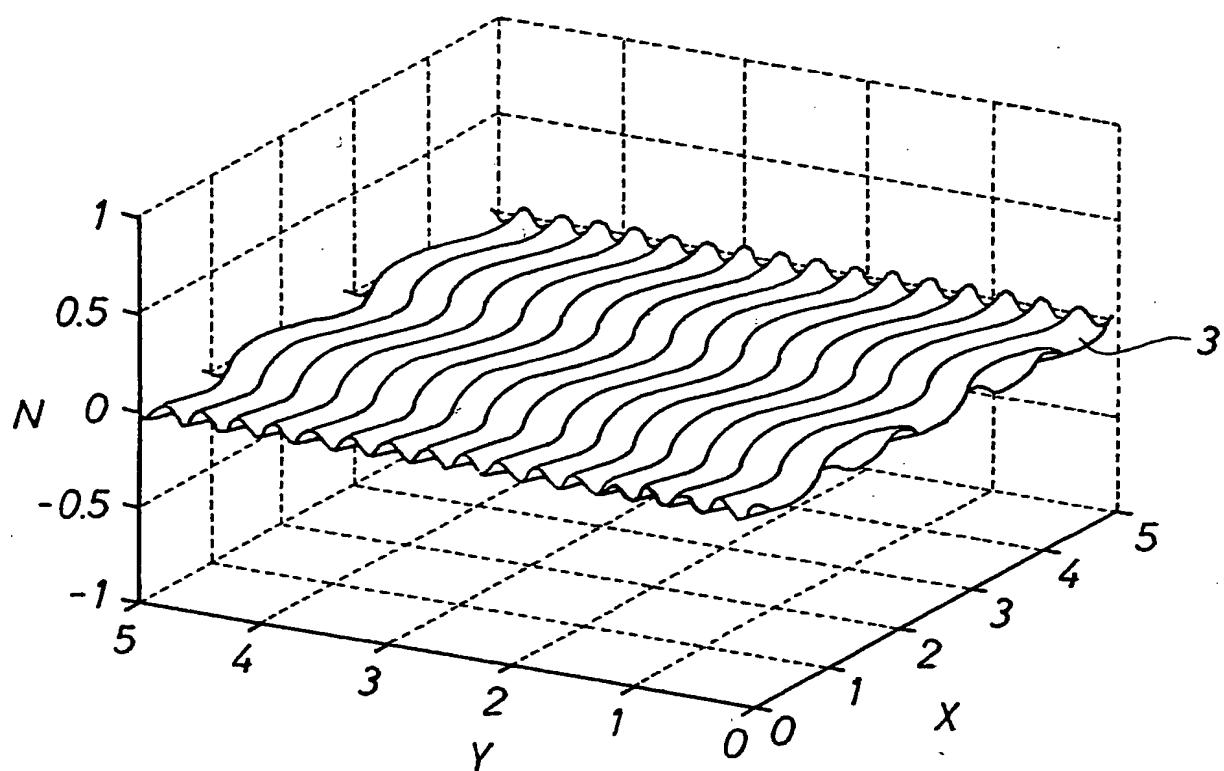


Fig. 2

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/03/00832

A. CLASSIFICATION OF SUBJECT MATTER  
 IPC 7 B65D65/40 B32B29/08 E04C2/32

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B65D B32B E04C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 424 526 A (ICHIKAWA HIROO) 2 May 1991 (1991-05-02) figures 1,18 ---	1-9
X	WO 00 71277 A (EVANS JONATHAN LESLIE ;BANRO HOLDINGS LTD (GB)) 30 November 2000 (2000-11-30) page 5, line 16 - line 22; figure 9 ---	1-9
A	EP 0 704 380 A (KOLB WELLPAPPE HANS) 3 April 1996 (1996-04-03) column 5, line 33 - line 36; figure 12 ---	1-9
A	US 6 207 242 B1 (HOFFMAN ROGER P) 27 March 2001 (2001-03-27) abstract ---	1-9 -/-

 Further documents are listed in the continuation of box C. Patent family members are listed in annex.

## \* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the International search

27 May 2003

Date of mailing of the international search report

25.07.2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl.  
Fax: (+31-70) 340-3016

Authorized officer

WILLIAM HELIN / ELY

## INTERNATIONAL SEARCH REPORT

Inte

al Application No

PCT/03/00832

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2 615 446 A (LUONG THANH MINH) 25 November 1988 (1988-11-25) page 1, line 17 - line 30; figure 1 -----	1-9

## INTERNATIONAL SEARCH REPORT

Inte	al Application No
PCT	03/00832

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
EP 0424526	A	02-05-1991		WO 9010537 A1 DE 68928301 D1 DE 68928301 T2 EP 0424526 A1 US 5314738 A		20-09-1990 09-10-1997 02-04-1998 02-05-1991 24-05-1994
WO 0071277	A	30-11-2000		AU 4583600 A WO 0071277 A1		12-12-2000 30-11-2000
EP 0704380	A	03-04-1996		DE 9414805 U1 EP 0704380 A1		17-11-1994 03-04-1996
US 6207242	B1	27-03-2001		US 5882746 A AU 5328499 A WO 0006462 A1 ZA 9904914 A US 6099674 A US 2001010845 A1		16-03-1999 21-02-2000 10-02-2000 22-09-2000 08-08-2000 02-08-2001
FR 2615446	A	25-11-1988	FR	2615446 A1		25-11-1988